Our membership and services span the globe
10 N Post St Ste 305 | Spokane WA 99201-0705
Phone: 509.624.1158 | Fax: 509.623.1241
E-mail: nwma_info@nwma.org | Web: www.nwma.org
EST 1895 NORTHWEST MINING ASSOCIATION

June 29, 2013

Ms. Robert Perciasepe
Acting Administrator
U.S. Environmental Protection Agency
Ariel Rios Building
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

Mr. Dennis McLerran
Regional Administrator
EPA Region X
RA 140
1200 Sixth Avenue
Seattle, Washington 98101

Re: EPA Docket # EPA-HQ-ORD-2013-0189
EPA's Revised Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska (Second External Review Draft)

Dear Acting Administrator Perciasepe,

The Northwest Mining Association (NWMA) appreciates the opportunity to comment on the Revised Draft Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska. We respectfully request that you disregard this assessment's findings. Site-specific evaluations of potential environmental impacts require a specific proposal and consideration of the federal and state statutory and regulatory hardrock mine programs that Congress, the States and the executive branch agencies have developed over the last 40 years to prevent and/or substantially mitigate environmental impacts.

EPA cannot possibly make a rational determination whether a hypothetical, mythical hardrock mine designed by EPA will have any rational correlation to a real world hardrock mine proposal without the benefit of input from hardrock mining professionals. EPA must use the processes for gathering facts, science and developing alternatives that have developed over the last 40 years pursuant to the federal National Environmental Policy Act (NEPA) and then evaluate the environmental protective measures considered by the federal and state permitting/approval authorities. These authorities have an impressive track record of protecting the environment from the impact of hardrock mines.

As is discussed below, since the advent of the current hardrock mine regulatory processes in the 1990's, there has never been an environmental problem at a hardrock mine permitted by the relevant federal or state agencies that required EPA to determine such hardrock mine site was "top priority among known response targets" for inclusion on the federal National Priorities List. Thus, it is arbitrary and capricious per se to abstractly assume than a *possible* mine that has yet to be proposed, has yet to be subject to factual and scientific evaluation, and has yet to be subject to environmental protective measures by the permitting/approval processes under currently applicable federal and state hardrock mine regulation programs will have unacceptable impacts. Yet, that is exactly what the Revised Bristol Bay Assessment purports to do. Therefore, NWMA strongly urges EPA to return to the rule of science and law and terminate further work on the current Bristol Bay Assessment. This premature and scientifically flawed Assessment is a complete waste of taxpayer dollars.

Who We Are

NWMA is a 118 year old, 2,300 member, non-profit, non-partisan trade association based in Spokane, Washington. NWMA members reside in 42 states, including more than 80 in Alaska, and are actively involved in exploration and mining operations on public and private lands. Our diverse membership includes every facet of the mining industry including geology, exploration, mining, engineering, equipment manufacturing, environmental protection, reclamation, technical services, and sales of equipment and supplies. NWMA's broad membership represents a true cross-section of the American mining community from small miners and exploration geologists to both junior and large mining companies. More than 80% of our members are small businesses or work for small businesses. Most of our members are individual citizens.

The EPA's Revised Assessment is flawed and does not meet federal Data Quality Act or EPA data quality guidance

EPA's Revised Bristol Bay Watershed Assessment (EPA Assessment) purports to rely on Clean Water Act Section 104 to undertake an assessment that might be used for a Section 404(c) veto of the Pebble Project. Although EPA claims that the EPA Assessment and a possible §404(c) veto is directed at a hypothetical project, it is clear to everyone that the yet-to-be-filed Pebble Plan of Operations is the target. In a letter from EPA to the State of Alaska dated April 5, 2012, EPA says that the EPA Assessment is not a regulatory action and that "it will not have any legal consequences." Even if EPA were accurate in its characterization of the Assessment's absence of legal effect, the Assessment by EPA's own acknowledgement might potentially be used in a Section 404(c) veto of a project that has not been proposed.

The State of Alaska has challenged EPA's legal authority under Section 104 to undertake the Assessment. Whether or not EPA has the authority to undertake studies without regulatory or other legal consequences, it is clear that EPA cannot prejudice the statutory and regulatory processes for considering proposals if and when they are made. Under NEPA, what constitutes a "proposal" is well defined by the NEPA statute, implementing regulations and guidance of many agencies, and the courts.

With respect to the evolving Pebble Project, all agree: No "proposal" has been made. If and when a proposal is made, EPA is unlikely to be a permitting agency for any Pebble Project as then proposed. Thus, EPA cannot use its dubious Clean Water Act § 104 assessment authority to prejudice the process that the lead and cooperating agencies will then undertake.

A critical element of any "proposal" is limiting environmental impacts and incorporating mitigation. Until a proposal is made, it is impossible to determine how the NEPA process should work. In some current instances, mining projects have so successfully limited impacts and incorporated enforceable mitigation that a "finding of no significant impact" was reached after completing an Environmental Assessment. In other instances, mining projects worked with the lead and cooperating agencies to complete an Environmental Impact Statement (EIS). In all instances, the agencies waited until a "proposal" existed. In the context of the evolving Pebble Project, no one now knows what the proposal will entail. EPA assumes that a § 404(c) veto may be considered, but, at this point, there is no § 404 permit application that might be forestalled by a veto.

Putting aside the accuracy of EPA's characterization of the EPA Assessment as lacking regulatory or other legal consequences, the development of the EPA Assessment and its wide dissemination, including attempts to make it appear the State of Alaska is cooperating, create serious prejudice against an evolving project that has not yet made a proposal subject to NEPA and other statutory analysis. EPA is using § 104 for purposes that have nothing to do with understanding the watershed or assisting the government and public in undertaking informed decision making, which is NEPA's overriding objective.

EPA's failure to consider the full panoply of federal and state programs developed by the Congress, the States and the relevant federal and state hardrock mine regulatory authorities to protect the environment when seeking to assess potential impacts of hardrock mines is shocking in view of the success the current regulatory programs have had in protecting the environmental since their inception in the 1990s.

The evolution of federal and state regulation of hardrock mining and milling facilities[1] is a remarkable success story of environmental protection. The bottom line is that current hardrock mine regulation is demonstrably protective of the environment. This is well illustrated by analysis of the vintages of Hardrock Mines on the EPA National Priorities List of environmental cleanup sites.

EPA prepared a subset of the National Priories List so-called "mining sites" referred to by EPA as the Abandoned Mines List ("EPA AML").[2] The EPA AML is highly misleading if one seeks to use it as a whole to suggest the environmental risk created by newly approved hardrock mines because the EPA AML is composed entirely of facilities that: (1) are mineral processing facilities and inorganic chemical plants that are almost never associated with hardrock mining or hardrock mines permitted in the current era; and/or (2) old, often historic (i.e., designed and primarily

[1] For the purposes of this letter, "hardrock mine" includes any facility deemed to be a "mining" or "beneficiation" facility by the EPA. EPA has defined "mining and beneficiation" to include, generally, all metal mines, but the term also includes many non-metallic industrial mineral mines, such as phosphate rock, trona, fluorospar, and mica, as well as the mills required to upgrade any of the these ores. See generally 40 C.F.R. 261.4(b)(7)(2012). In common usage, EPA's "mining and beneficiation" is more typically referred to as "hardrock mining and milling" or just for the purposes of this letter sometimes "hardrock mine."
[2] EPA's "Summary – Mining Sites on the National Priorities List," March 20, 2012.

constructed more than 50 years ago), hardrock mines or mills that were never subject to current regulatory approval requirements.

When one eliminates the "red herring" inorganic chemical plants and mineral processing facilities, the EPA AML list of almost 100 sites is immediately reduced in half to about 50 possible mining and milling facilities that might be deemed to be "hardrock mines."

However, when one takes into account the nature of the regulatory protections, if any, that had been applied to these approximately 50 sites to protect the environment, one quickly learns that most of these facilities were never subject to *any* regulatory limitations to protect the environment. EPA's 1985 assessment was that "EPA data on management methods at mining facilities indicate that only a small percentage of mines currently [1985] monitor their ground water, use run-on/run-off controls or liner, or employ leachate collection, detection, and removal systems."[3] Thus, as a practical matter, any discussion of the current effectiveness of environmental predictions at facilities designed and approved prior to 1985 is meaningless. No one would suggest today that General Motors ("GM") should be prohibited from producing cars in 2013 because GM's 1965 Corvair was deemed to be "unsafe at any speed" by Ralph Nader.[4] GM did not meet 2013 regulatory standards in 1965 and neither did the hardrock mine industry, yet both the auto industry and the hardrock mining industry must continue to fulfill their role in the U.S. economy.

Hardrock mine regulation can be broadly classified into 3 major eras based upon the extent of applicable regulation or the lack thereof: (1) Pre-Regulatory Era (prior to 1970); (2) Transition Regulatory Era (1970 through 1990); and, (3) Regulated Hardrock Mine Era (Post-1990).

Although EPA has placed a small number of hardrock mines designed and constructed in the Transition Regulatory Era, *none* of the hardrock mines on the National Priorities List ("NPL") were approved after 1990. This topic is addressed in greater detail by separate report prepared by Baird Hanson LLP for submittal to this EPA docket "Hardrock Mining Reclamation and Regulation – Developing Sustainable Environmental Protection through Changing Values, Changing Laws and Experience – A Federal and State Regulatory Success Case Study."

Importantly, the determination that current hardrock mine regulation has been generally effective is not merely the opinion of the NWMA; it is validated by data supplied by the USFS and the BLM with regard to hardrock mines on federal land. By letter dated, March 8, 2011, U.S. Senator Lisa Murkowski (R-AK) asked the Forest Service and the BLM how many mine plans of operations ("MPOs") the agencies had approved since 1990 and asked how many of those approved MPO facilities subsequently were listed by EPA on the NPL? The Forest Service responded to Senator Murkowski by stating that they had approved 2,685 MPOs since 1990 and

[3] EPA, "Report to Congress, Wastes from the Extraction and Beneficiation of Metallic Ores, Phosphate Rock, Asbestos, Overburden from Uranium Mining, and Oil Shale," December 31, 1985, p. ES-10.
[4] Nader, Ralph, Unsafe at any speed: The Designed in Dangers of the American Automobile, Grossman Publishers, 1965.

stated that ***none*** of these required EPA to place them on the NPL.[5] The BLM responded to Senator Murkowski by stating that they had approved 659 MPOs after 1990 and stated that ***none*** of these required EPA to place them on the NPL.[6] Thus, while federal land approvals do not encompass *all* hardrock mines, this independently verifies the CERCLA National Priorities List analysis above. None of the hardrock mines approved for operation on federal land since 1990 have been deemed by the EPA to be among the "top priority among known response targets."

To briefly summarize, there has never been an environmental problem at a hardrock mine approved by a federal or state agency after 1990 that required EPA to make it a Superfund "top priority among known response targets." More specifically, no hardrock mine regulatorily-approved after 1990 has ever been placed on EPA's Superfund National Priorities List. The reason for this is simple. Current hardrock mine regulation is protecting the environment. This is not just the opinion of the relevant agencies or the hardrock mining industry; it is the opinion of both the National Academy of Sciences National Research Council and the bi-partisan Western Governors' Association, as discussed immediately below.

Current hardrock mine regulation on federal lands by the Forest Service and the BLM was determined to be "complicated, but generally effective" by the federal government's independent National Academy of Sciences National Research Council in 1999.[7] Additionally, in 2010, the bi-partisan Western Governors' Association stated that the Western States, which regulate hardrock mining on state and private lands within their borders "… uniformly impose permit conditions and stringent design and operating standards, to ensure that hardrock mining operations are conducted in a manner that is protective of human health and the environment."[8] Thus, collectively, the Forest Service, the BLM, and the Western States' environmental agencies, in concert with the hardrock mining industry, have prevented any hardrock mine designed and approved after 1990 from being deemed by EPA to be a "top priority" cleanup site. This is a noteworthy achievement.

Despite the multiple sources of information supporting the general effectiveness of current hardrock mine regulation, EPA and non-governmental organizations (NGO's), such as Earthworks and their agents, continue to dredge up the irrelevant past for damage cases and mischaracterize the record of hardrock mine environmental compliance. This approach ignores the regulatory protections actually in place. EPA's Revised Assessment does exactly this, for example, when it refers to a 2006 document by James Kuipers, Ann Maest and others, entitled *Comparison of Predicted and Actual Water Quality at Hardrock Mines: The reliability of predictions in Environmental Impact Statements (Kuipers Maest et al 2006)*. For these reasons, NWMA commissioned a preliminary review and analysis conducted by Schlumberger Water

[5] Letter from Secretary of Agriculture (Forest Service response), Thomas J. Vilsack to Senator Murkowski (R-AK), July 20, 2011.
[6] Letter from BLM Director, Robert Abbey to Senator Murkowski (R-AK), June 21, 2011.
[7] *Hardrock Mining on Federal Lands,* National Research Council, National Academy Press, 1999, p. 89.
[8] Western Governors Association, Policy Resolution 10-16, Background (A)(8) (regarding "National Minerals Policy")

Services of *Kuipers Maest et al, 2006*. The technical review and findings are incorporated by reference as though fully set out herein and attached as appendix to our comments.

The technical review finds that the report is deficient for the following reasons:

- The conclusions contained in the report are not relevant to any current mines that are being permitted, or to any future mines. Modern-day characterization and analysis techniques have changed so radically from virtually all of the studies cited by the report that it is meaningless to draw any comparison to modern-day conditions.

- The conclusions regarding water quality exceedences cannot be validated. There are virtually no data presented that support the conclusions. Where data are available, the cited exceedences are often for internal and trigger monitoring points rather than for compliance points that affect the surrounding environment and receptors.

- The data set used in the report includes historical sites, which were developed prior to modern regulations. The study also includes a preponderance of mine sites that were studied and permitted during the transition period from un-regulated activity to modern regulation.

- The report draws conclusions based upon technical work that is old, and may no longer be technically supportable or valid. There is an under-representation of mine sites which have been studied, permitted, operated, and regulated using modern-day methods.

- The case studies examined by the current review indicate that the report has serious problems in the way that data are interpreted and in the way conclusions are drawn.

- Throughout much of the report, the cited data are discussed out of context and mostly in isolation. There is no attempt to understand the conceptual model, the hydrogeological and geochemical processes involved, or the site-specific nature and layout of the mine sites discussed. Consequently, much of the data interpretation and resulting conclusions are misleading.

- The report neglects that increasing data collection and improved models and predictive methodologies contribute to refinements in predictions and site conceptual models. This despite the authors acknowledging the same in their 2005 report on state-of-the-art of predictive methods wherein they include the quote: "The site conceptual model must be representative of the most important processes and reactions that will occur over time on the mine site, and *it can change with time at the mine site and as more information is collected*" (Bredehoeft, 2005). (Emphasis added)

- The report has defined "impacts" differently from most regulatory bodies with which the mining industry has to comply. The report defines an exceedence of surface or groundwater quality as any parameter above a primary or secondary surface or groundwater drinking water standard regardless of whether it is in compliance with permit conditions or regulations.

- The report argues that many of the exceedences are due to "characterization failures". However, virtually all of the EISs for the study mines cited in the report were prepared prior to the BLM guidance for water resource and rock characterization and analysis.

- The report includes very little consideration of ambient hydrogeological conditions that were present prior to the development of the mining operation, and particularly cases where modern-day mining has cleaned up older mining operations.

- It is not possible to recreate the summary statistics cited in the report using the information provided for the case study mine sites.

- Scoring systems used in the report have unrealistically low criteria to define the severity of potential impacts

- Kuipers Maest et al, 2006 is a not peer-reviewed study and is a misleading "white paper" funded by the anti-mining advocacy group Earthworks.

And, yet EPA's Revised Assessment uses such misleading analysis to ignore the effectiveness of current and future mine regulation.

Apparently realizing the serious concerns with the biased nature and lack of any scientific validation of *Kuipers Maest et al, 2006* report, EPA attempted, as part of the Revised Bristol Bay Assessment, to conduct its own quasi-per review to ensure that the highly flawed white paper was, "of sufficient scientific quality and credibility to be incorporated into the second external review draft of the Bristol Bay Assessment."

Several of EPA's peer reviewers expressed concern with the both the validity and biased nature of the reports' conclusion. The sole EPA hand-picked reviewer that supported the conclusions of the *Kuipers Maest et al, 2006* paper was David A. Atkins, former Managing Scientist for Stratus Consulting, and the firm at which the report's coauthor Ann Maest works. Additionally, *Kuipers Maest et al, 2006* references two publications actually written by Mr. Atkins, including one that he co-authored with Ms. Maest.

The Revised Bristol Bay Assessment cites *Kuipers Maest et al, 2006* and Wobus et al. (2012) – both coauthored by Ms. Ann Maest, Managing Scientist for Stratus Consulting a total of 11 times in the text of the Bristol Bay Assessment.

The work of Ms. Maest in general is a concern due to recent events stemming from a federal lawsuit brought against Ms. Maest and Stratus Consulting by Chevron for the work conducted on behalf of plaintiff's attorney in an environmental tort case in Ecuador.

The claims against Maest and Stratus Consulting were dropped but only after they published a 28-page affidavit accompanied by 16 pages of individual declarations disavowing the research they had produced in Ecuador.

Ms. Maest disavowing her own work in the Chevron case causes serious concern over the validity of all of her work and methods used; and at the very least necessitate a higher degree of scrutiny before it is relied upon to such an extent.

EPA's Revised Assessment is based on a hypothetical mine that could not be permitted under existing State of Alaska and federal law requirements.

No large scale modern mine (within the past 25 years) has been approved exactly as proposed by the company. Each of the many State and federal agencies review the permit application, baseline data and EIS requirements and each requires large or minor changes before it is satisfied that the mine will be able to operate according to that agency's requirements.

EPA's Revised Assessment assumes designs for various aspects of the mine and then criticizes those designs as not being acceptable. EPA's Revised Assessment does not effectively address avoidance, minimization and mitigation, all of which are employed by the agencies and the companies to address concerns that arise over the initial design. This approach to "assume design and then say it is not acceptable" was used in EPA's Revised Assessment for: siting of mine facilities, siting of roads, siting of tailings pipeline, design of bridges, tailings management, water use, water discharge, financial assurance (bonding), etc.

In no case can a programmatic EIS be used for permitting an individual mine. Every mine is required to have a site specific EIS based on the specific design details and environmental data for all aspects of the mine. Yet, the EPA Assessment uses a hypothetical design to evaluate the potential impacts on the entire Bristol Bay region, an area larger than the State of West Virginia.

As a result of the above items the EPA hypothetical Assessment cannot provide an accurate evaluation of the potential impacts of a large scale mine.

EPA's Revised Assessment uses this hypothetical mine to represent all future large scale mining in the Bristol Bay watershed.

EPA's Revised Assessment states that Pebble would be the largest mine of its type in the U.S. (which is not a true statement – the Bingham Canyon Mine has operated for more than 140 years and at some periods during its mine life has milled up to 500,000 tons per day as compared to the EPA Assessment use of 200,000 tons per day) and then utilizes the hypothetical mine focused on Pebble to represent all other large mines that could ever be developed in the Bristol Bay Watershed. This approach is blatantly wrong. If Pebble will be the largest, how can any others also be this large?

The Assessment is fatally flawed when it assumes all other large scale mines in the region will look the same as the EPA hypothetical mine. Every mineral deposit is different and must be evaluated based on its particular geology, geochemistry, metallurgy, environmental setting, etc. The result is that every mine layout is different, every mine plan is different, every mill is different, every tailings impoundment is unique, etc.

As stated above, in no case can a programmatic EIS be used for permitting an individual mine. Every mine is required to have a site specific EIS based on the specific design details and environmental data for all aspects of the mine. Yet, the EPA Revised Assessment uses a hypothetical design to evaluate the potential impacts on the entire Bristol Bay region.

EPA's Revised Assessment makes conclusions in the Executive Summary that are not supported by the body of the Assessment and in some cases contradicts the information presented in the body of the Assessment.

The Executive Summary conclusion in Table ES-1 lists the probability of problems with water collection and treatment as "High" during operation and "High" during post-closure. However, this contradicts Section 6.3.4 of the Assessment which concludes that one cannot quantify or predict risk of collection or treatment failure which is a reasonable conclusion given the uncertainties described. It reads, "The risks from water collection and treatment failures are highly uncertain…The range of failures is wide and the probability of occurrence of any of them cannot be estimated from available data." (p. 6-41). It is arbitrary and capricious for the Executive Summary to make a statement that is in direct opposition to the conclusions within the Assessment.

The Executive Summary (p. ES-21) reads "Based on a review of historical and currently operating mines, some failure of the collection and treatment systems is likely during operation of post-closure periods." It then goes on to describe toxic effects that would likely kill thousands of fish. Yet the analysis in Section 6 of the Assessment indicates that the probability "cannot be estimated form the data." The Executive Summary also summarizes the analysis by saying that EPA reviewed the data and found the probability "High." The Assessment includes no data about frequency of failure.

The Executive Summary also contradicts the Assessment analysis because there is no documentation of a "review of historical and currently operating mines" anywhere in the Assessment. Their conclusion is also contradicted by Alaska's record. There is no justification or basis given for the Summary's conclusion and it even contradicts and distorts the analysis in the body of the Assessment. It is arbitrary and capricious for the Executive Summary to make a statement that is not supported by the data and is in direct opposition to Alaska's record over the past 25 years.

EPA's Revised Assessment purports to be an "ecological risk assessment" but admits that it does not have the necessary data to evaluate the impacts and therefore assumes what the impacts would be.

It has been well established that an ecological risk assessment approach cannot be used to evaluate a hypothetical project or any project before there is an actual design that can be tested. A pre-design ecological risk assessment does not have the baseline and the specific design parameters and cannot provide a meaningful analysis. A pre-design ecological assessment cannot evaluate and consider the prevention and mitigation strategies that are always part of every mine design evaluation and EIS.

EPA's Revised Assessment purports to be a scientific assessment but admits that it does not have the baseline data or the mine design which would be required to make a scientific evaluation of a mine.

Conclusion

The federal and state regulatory agencies and the mining industry have collectively made tremendous strides in the past few decades developing environmentally sound mines based on continually improving state-of-the-art technology and best practices. Thus, it is hard to understand why EPA would seek to conduct a hardrock risk analysis without considering and allowing the application of such successful environmentally protective programs. The EPA's preemptive action and the unnecessary and premature watershed study could cripple America's crucial mining industry as uncertainty increases investment risk and dries up investment in exploration and mine development. We are deeply concerned that the approval of such a flawed report does not meet the standard of which the federal government is obligated to hold toward its constituents.

NWMA incorporates by reference the comments of The Pebble Partnership, the Alaska Miners Association and the Resource Development Council.

Thank you for your consideration of our comments.

Sincerely,

Laura Skaer

Laura Skaer
Executive Director

Attachment: Technical Review of Kuipers Maest

cc: Dennis McLerran, Regional Administrator
Senator Lisa Murkowski
Senator Mark Begich

Technical Review of Kuipers Maest, 2006, "Comparison of predicted and actual water quality at hardrock mines: The reliability of predictions in Environmental Impact Statements"

June 28, 2013

Prepared for:

Northwest Mining Association.

Prepared by:

Schlumberger Water Services
1875 Lawrence St. Suite 500
Denver, CO 80202

For submittal to:

EPA Docket – EPA-910-R-12-004Ba-c
"An Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska"
http://www2.epa.gov/bristolbay/current -public-involvement

CONTENTS

1 EXECUTIVE SUMMARY

The purpose of this document is to assess the accuracy of statements and review conclusions made in the report entitled "*Comparison of Predicted and Actual Water Quality at Hardrock Mines – the reliability of predictions in Environmental Impact Statements*" by Ann S. Maest and *James R. Kuipers, et al., December 7, 2006* (the "Kuipers Maest Report"). The Kuipers Maest Report purports to provide an assessment of the adequacy of predictions made during National Environmental Policy Act (NEPA) processes at mine sites. The authors note it was ultimately "intended to advance the practice of science, engineering and regulation related to water quality prediction, the recognition of risk, and the application of effective mitigation to hard rock mines".

The review consists of a dual effort. One effort looked at the Kuipers Maest Report to determine whether the conclusions are supported by information contained in the report. It is important for scientific reviews to allow the reader to independently verify the methodology and data cited in support of the conclusions. The other effort looked beyond the Kuipers Maest Report for important information on the history of regulatory and scientific development that is completely absent from the report and also for information on actual conditions at the study mines. The history of regulatory and scientific development is then compared against the dates of preparation of the EIS studies cited by the report.

The review of the Kuipers Maest Report finds that:

- The conclusions contained in the report are not relevant to any current mines that are being permitted, or to any future mines. Modern-day characterization and analysis techniques have changed so radically from virtually all of the studies cited by the report that it is meaningless to draw any comparison to modern-day conditions.

- The conclusions regarding water quality exceedences cannot be validated. There are virtually no data presented that support the conclusions. Where data are available, the cited exceedences are often for internal and trigger monitoring points rather than for compliance points that affect the surrounding environment and receptors.

- The data set used in the report includes historical sites, which were developed prior to modern regulations. The study also includes a preponderance of mine sites that were studied and permitted during the transition period from un-regulated activity to modern regulation.

- The report draws conclusions based upon technical work that is old, and may no longer be technically supportable or valid. There is an under-representation of mine sites which have been studied, permitted, operated, and regulated using modern-day methods.

- The case studies examined by the current review indicate that the report has serious problems in the way that data are interpreted and in the way conclusions are drawn.

- Throughout much of the report, the cited data are discussed out of context and mostly in isolation. There is no attempt to understand the conceptual model, the hydrogeological and geochemical processes involved, or the site-specific nature and layout of the mine sites discussed. Consequently, much of the data interpretation and resulting conclusions are misleading.

- The report neglects that increasing data collection and improved models and predictive methodologies contribute to refinements in predictions and site conceptual models. This despite the authors acknowledging the same in their 2005 report on state-of-the-art of predictive methods wherein they include the quote: *"The site conceptual model must be representative of the most important processes and reactions that will occur over time on the mine site, and <u>it can change with time at the mine site and as more information is collected"</u> (Bredehoeft, 2005.)*

- The report has defined "impacts" differently from most regulatory bodies with which the mining industry has to comply. The report defines an exceedence of surface or groundwater quality as any parameter above a primary or secondary surface or groundwater drinking water standard regardless of whether it is in compliance with permit conditions or regulations.

- The report argues that many of the exceedences are due to "characterization failures". However, virtually all of the EISs for the study mines cited in the report were prepared prior to the BLM guidance for water resource and rock characterization and analysis.

- The report includes very little consideration of ambient hydrogeological conditions that were present prior to the development of the mining operation, and particularly cases where modern-day mining has cleaned up older mining operations.

- It is not possible to recreate the summary statistics cited in the report using the information provided for the case study mine sites.

- Scoring systems used in the report have unrealistically low criteria to define the severity of potential impacts

2 REGULATORY FRAMEWORK

Mining regulation and NEPA compliance by the agencies has evolved throughout the period of the Kuipers Maest Report and continues to evolve today. To consider how this might have affected the preparation of NEPA documents, the history of NEPA implementation in various agencies was examined along with other important regulatory developments. Table 2.1 shows important regulatory milestones.

As Table 2.1 shows, even though NEPA was signed into law in 1970, the Council on Environmental Quality (CEQ) did not issue its first regulations until 1978 and some of its most important guidance until 1983.

The Bureau of Land Management (BLM) issued general NEPA procedures in 1970 This guidance was somewhat out of context as the BLM did not fall under the Federal Land Policy and Management Act (FLPMA) until 1976. That act, among other things, directed BLM to undertake systematic planning for management of lands under its jurisdiction. The systematic planning involved all resources on BLM-managed lands, including mining operations. The Federal Land Policy and Management Act (FLPMA) thrust BLM into the NEPA compliance realm in a major way. It was not until 1988 that the BLM issued specific NEPA guidance addressing mining, among other subjects.

The Nevada BLM, recognizing the need for well-documented NEPA analyses and standardization of procedures, issued policies, and guidance on water resource data and analysis and rock characterization beginning in 1998. In addition, Nevada BLM first issued groundwater modeling guidance in 2008. Prior to1998 there was little to no standardization for these analyses. In recognition of the ever-advancing regulatory and technical framework, BLM updates these policies and guidance regularly.

The Forest Service issued NEPA implementation procedures in 1979. Their mining regulation practices continued to evolve and guidance on mine bonding was issued in 2004.

The Army Corps of Engineers has also undergone an evolving process for regulating activities in wetlands, which is the basis for their involvement in many mining sites. In 1987 the ACOE issued a manual for delineating wetlands. This was followed by an attempt to redefine the delineation procedure in a 1989 manual that was ultimately withdrawn and the 1987 manual reinstituted. The ACOE issued NEPA implementing regulations in 1988.

Prior to passage of the Clean Water Act in 1972, there was no prohibition on discharges to surface waters. Facilities constructed prior to this were not necessarily designed to prevent discharges to surface waters. The effluent limits for metal mines were not promulgated until December 1982.

Table 2.1 NEPA and Major Regulatory Milestones

Action	What	Date	Citation
NEPA becomes law	Federal Statute	1970	42 USC 4321
CEQ Related Activities			
CEQ authorized to issue non-binding regulations	Executive order	1970	
CEQ receives authority to issue regulations	Executive order	1977	
NEPA regulations	CEQ Regulation	1978	43 FR 55990
Forty Most Asked Questions published	CEQ Guidance	1981	46 FR 18026
CEQ Guidance on NEPA regulations	CEQ Guidance	1983	48 FR 34263
BLM Related Activities			
Department of Interior NEPA Procedures	Interior Department Guidance	1970	516 DM 1-7
Federal Land Policy and Management Act	Federal Statute	1976	43 USC 1701
BLM publishes NEPA Handbook	BLM Guidance	1988	BLM Handbook H-1790-1
Nevada BLM publishes Water Resource Data and Analysis Policy	BLM Policy	1998	Nevada BLM Policy
Nevada BLM publishes Rock Characterization and Water Resource Analysis Guidance for Mining Activities	BLM Guidance	1998	Nevada BLM Guidance
Nevada BLM publishes Groundwater Modeling Guidance for Mining Activities	BLM Policy	2008	Nevada BLM Guidance
Forest Service Related Activities			
National Forest Management Act	Federal Statute	1976	16 USC 1600
Forest Service NEPA implementation procedures	Forest Service Regulation	1979	44 FR 44718
Forest Service Reclamation Bonding guidance	Forest Service Guidance	2004	USDA Forest Service April, 2004
Army Corps of Engineers Related Activities			
Clean Water Act	Federal Statute	1972	33 USC 1251
Directive to protect wetlands	Executive Order	1977	Executive Order 11990
ACOE Wetland Regulations	ACOE Regulation	1977	
Wetlands Delineation Manual	ACOE Technical Manual	1987	US ACE Wetlands Delineation Manual, 1987
ACOE Procedures for Implementing NEPA	ACOE Regulation	1988	53 FR 3127
Other Related Developments			
Effluent limitations for metal mines promulgated under Clean Water Act	EPA Regulation	1982	47 FR 54609
CERCLA Enacted	Federal Statute	1980	42 USC 9601
SARA Enacted	Federal Statute	1986	42 USC 11001

Prior to the enactment of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) in 1980, there was little, if any, indication of groundwater standards developing under law. The SARA amendments in 1987 clarified that drinking water standards would be applied at CERCLA sites, indicating that avoiding discharges to groundwater was necessary to avoid CERCLA enforcement.

Thus, prior to 1972 for surface water, and 1987 for groundwater, there were no meaningful targets or limitations for mine designers to use for mitigation design, or for EIS evaluations to use for comparative purposes.

The point of this discussion is that NEPA compliance and mining regulation, while still evolving today, was in its infancy during the 1970s and 1980s. The mining industry and the principal Federal mining regulatory agencies (BLM, Forest Service, and ACOE) were working in an unsettled environment during this period, including rapidly changing statutes and regulations and rapidly evolving technical processes.

3 TECHNICAL FRAMEWORK

3.1 Background

The application of scientific hydrology studies to mine sites can be traced back to the 1950s. However, the majority of the work prior to the mid-1980s was focused on specific engineering issues that related mostly to mine dewatering or water supply. A real awareness of potential surface and groundwater contamination issues associated with industrial developments only started in the late 1970s and 1980s.

The United States and Canada were among the first countries to adopt environmental procedures for mine sites and other industrial developments. Mining companies typically started to employ on-site and corporate environmental officers from the late 1980s. However, many of the early mining environmental staff had limited technical background because of the inherent lack of experience associated with this new discipline.

In the 1990s, the hard rock mining industry became highly proactive in response to the increasing environmental regulation and guidelines, and rapidly developed in-house environmental expertise and corporate governance to a higher standard. The mining industry led the development of procedures and standards for surface and groundwater ahead of many other industrial sectors.

All of the major mining companies now have a high level of environmental awareness, both at a corporate level and at an operations level. In many countries, the environmental standards imposed on a project by the mining company itself are typically more rigorous than those demanded by local regulations.

Both hydrogeology and geochemistry models are only as good as input data available to represent the system under investigation. Development of a proper conceptual model is fundamental for any meaningful numerical analysis. Until the 1990s, the available input data for the predictive tools for estimating how rocks behave under weathering was based upon relatively crude test work with no real-world monitoring. The use of case studies and site monitoring experience to provide the ability to calibrate and validate modeling procedures within the past 10 years has been fundamental for establishing the current-day procedures.

The establishment of procedures by Federal and State regulators has only become commonplace since the late 1990s and early 2000s as a result of the improved technical understanding gained by the agencies. Most of the guidance for geochemistry testing for NEPA documents were developed starting in the late 1990s (Table 2.1).

As a result, scientifically-supported EIS documents have only been available since the mid to late 1990s. Many of the EIS studies that were carried out prior to the mid-1990s used procedures which are now superseded, and they did not include the concepts of uncertainty and mitigation. Therefore, it is only in the last 10 to 15 years or so that higher quality EIS studies have become available with substantially improved predictive protocols.

3.2 Hydrogeologic modeling

Current-day methods and procedures for predictive technical studies for mine sites are vastly different to those that were utilized ten or more years ago. Groundwater modeling codes were first developed in the 1980s but were not widely applied to mine sites until the late 1980s and early 1990s. There was virtually no groundwater modeling to support EIS documents until the early 1990s. Early groundwater models for mine sites were generally un-validated because of the lack of historic data to provide input or to calibrate the models. Furthermore, the early models were basic and did not focus on developing a proper conceptual model, and they did not typically include the present-day concepts of sensitivity, uncertainty and mitigation. It was not until the mid to late-1990s that representative groundwater models were applied in support of EIS studies, and the concept of uncertainty and mitigation was introduced into the forward model predictions.

3.3 Geochemical testing and modeling

A practical understanding of the environmental geology of mineral deposits has only really developed within approximately the last 15 years. A good knowledge of the geology is critical for achieving a realistic conceptualization of processes effecting surface and groundwater quality impacts, which the predictive studies are attempting to model. The early laboratory testing procedures for geochemistry characterization did not recognize some of the physical and chemical controls that are now known to influence the testing results, and therefore some the early laboratory results were poorly constrained.

Although procedures for geochemistry characterization and modeling were developed somewhat later than those for hydrology studies, they have also evolved significantly over the past decade as good validation data for the models have become available. The first site geochemistry characterizations that approached modern-day standards occurred in the mid-1990s. However, these early studies had no basis for comparing the theoretical laboratory characterization results with actual mobilization and transport of chemical constituents.

"Predicting Water Quality at Hard Rock Mines", nominally a peer reviewed report on models, methods and state-of-the-art hydrological and geochemical prediction techniques, states "Predictive modeling of water quality at mine sites is an evolving science with inherent uncertainties" (Kuipers Maest, 2006). The report further notes the study brings together information on water quality predictions at mine sites with approaches developed primarily in the United States, Canada, and Australia, especially in the last 10 years.

This information is consistent with the Kuipers Maest Report (page 85), which states "EISs performed after about 1990 should have more reliable information on water quality impact potential than those EISs completed before this time" and "The availability of geochemical characterization data affects the ability to determine the potential for mines to release contaminants to water resources". With this in mind, the evolution of the geochemical and hydrologic evaluations in earlier NEPA documents (late 1970s to early 1990s) would be expected to be less detailed and precise than an evaluation prepared for a mine after the mid-1990s.

At the Green's Creek Mine, the 1983 EIS identified the potential for the project to degrade surface and/or groundwater as a result of potential acid drainage even though no specific geochemical testing was identified (USFS 1983). The 1992 Environmental Assessment (EA) for waste rock included metals analysis, acid-base accounting (ABA), synthethic precipitation leaching procedure (SPLP) and leachate modeling (USFS 1992). This testing indicated that some waste rock had the potential to produce acid, but a greater portion was acid neutralizing and no net acid production was expected. Waste rock leachate was predicted to have zinc concentrations in the range of 0.5 to 1.3 mg/l. The actual data discussion in the Kuipers Maest Report did not mention the waste rock leachate as being acidic. It did note the average zinc concentration was slightly higher than predicted at 1.65 mg/l. However, this number is in good agreement with the predictions and well below the discharge permit requirement (and secondary drinking water standard for zinc of 5 mg/l as identified in EPA, 2008).

At the Golden Sunlight Mine, despite a test indicating the ore may be acid generating, the ore body evaluated in the 1981 EIS was determined to be oxidized and common knowledge at the time was that oxide ores were non-acid generating. Therefore, no acid rock drainage (ARD) assessment or contingency plans for ARD were required by the state. According to Sandi Olsen (previously with Hard Rock Bureau of the MDEQ, personal communication 2004), Montana regulators started looking at ARD issues in about 1989 when the Golden Sunlight Mine planned to mine deep, low-grade, unoxidized ore. Subsequent evaluations correctly identified the high acid-generating potential of ore and waste rock.

3.4 Kuipers Maest Report and EISs

During the period from 1970 through the early 2000s, the passage of environmental laws lead to new regulations, which in turn spurred technical development that resulted in new regulatory guidance. It was a period of rapid (if uneven) change, which produced the current predictive modeling capabilities that are well-vetted, calibrated, and reproducible. It is likely that technical advances will continue.

Surface water quality standards were largely non-existent prior to 1972 and groundwater standards were similarly vague to non-existent until 1987. Development of predictive methodologies trailed behind these regulatory developments by 5 to 10 years. It was not until the late 1990s that predictive techniques were developed and standardized to a level that could be calibrated and verified. The Nevada BLM recognized this state of development in 1998 and began issuing guidance for technical analyses.

It is only in the last ten years or so that the mining industry has had the opportunity to monitor sites during operations and/or closure for which modeling predictions had previously been made, and therefore has had the opportunity to compare model results to reality. This has been fundamental to improving the methods and procedures for both the hydrogeology and geochemistry models to the current standard. Geochemistry databases and levels of practical understanding have only been sufficient to provide meaningful predictions since the early 2000s.

Because scientific study methods have evolved rapidly, and because the understanding of both mining operators and the regulators has greatly improved within the last 10 years or so, there is little to be gained by comparing the results of early EIS studies to actual conditions. Many mine sites have updated their previous studies, predictions, and mitigation plans using updated and more applicable analytical and predictive models. Therefore, comparison of the old EIS studies cited in the Kuipers Maest Report to actual operating conditions is misleading and is not useful for either the regulator or the general public.

There have only been a small number of new mines permitted since the adoption of modern-day procedures and standards. However, many mines are currently operating under the guidance of more recent supplementary NEPA studies or State-lead permitting, rather than the original EIS predictions. Virtually all of the mines that were cited as examples in the Kuipers Maest Report were permitted and constructed prior to the application of modern-day technical studies and modern EIS standards.

Many of the currently-operating mines in the United States and Canada are expansions of existing operations or re-development of existing Brownfield sites. In the majority of cases, the original mine development was carried out prior to the advent of baseline surface and groundwater studies, such that there is no proper baseline characterization of naturally elevated constituents, which commonly occur in the hydrologic system around mineralized areas. Many of the compliance exceedences cited in the Kuipers Maest Report are not valid because there are no baseline data upon which to compare the current conditions.

In fact, there are a large number of instances where comparatively recent mine expansions have helped the clean-up of historic sites as a result of the new standards imposed by the mining company itself. Any proper study on the environmental changes caused by mining would need to consider these aspects.

Of the 25 case studies used in the Kuipers Maest Report, only four sites were developed under current (post-1998) NEPA guidelines. The original EA and EIS documents for 21 of the case study sites were not developed using currently-applied scientific procedures. The majority of the sites have been expanded and re-engineered since the original EIS, and the more recent studies and analyses supersede the original work that is cited in the Kuipers Maest Report. The Kuipers Maest Report has made no attempt to consider the updated environmental analysis associated with the expansions. The reason for this is not apparent as most of the data and more recent permitting documents are on file with the applicable Federal or State agency and are publically available.

Therefore, in summary:

- The Kuipers Maest Report draws conclusions based upon studies that are old and are no longer representative of current environmental permitting and predictive protocols,
- The Kuipers Maest Report makes some attempt to consider baseline conditions but rarely considers the fact that historic unregulated mining occurred at the sites,
- The Kuipers Maest Report makes no attempt to review updated studies and analysis that are publically available and supersede the original analyses,
- The Kuipers Maest Report does not include any evaluation of any EIS documents that were prepared using the modern-day rigorous analytical methods, which would be applied to any future mine development.

4 EVALUATION OF SUMMARY STATISTICS IN THE KUIPERS MAEST REPORT

4.1 Criteria used to select the case study mines

The Kuipers Maest Report contains a number of summary statistics to show the impact to surface and groundwater quality from mining. The statistics are based on the 25 case study mines, which were considered to be representative of "the distribution of general categories and water quality-related elements that are present in the larger subsets of hard rock mines in the United States". The authors note the 25 case study mines were chosen primarily due to the availability of water quality data for the "actual water quality" assessment. As stated on page 87 of the Kuipers Maest Report: "In making the final selection of mines for in-depth study, the following priorities were identified":

- Mines with long histories and NEPA documentation from new project to reclamation and closure.
- Mines with different proximities to water resources but indicating water quality impacts.
- Mines that conducted some geochemical testing, and if possible, some water quality modeling.
- Mines with different potentials to generate acid and leach contaminants to water resources.

The document also states the "list of mines that actually meet these criteria, particularly with respect to adequate reliable evaluations that have addressed water quality predictions and impacts, and are publicly available, is limited".

As noted above, it appears that including mines with water quality impacts was a priority, and the case studies were selected based on available water quality data. Therefore, the validity of the conclusions from the Kuipers Maest Report and their applicability to the mining industry in general is questionable.

4.2 Definitions

During analysis of the information to determine which mines had exceeded water quality standards, the Kuipers Maest Report used the following definitions:

Water quality impact: increases in water quality parameters measured anywhere, as a result of mining operations, whether or not an exceedence of water quality standards or permit levels has occurred.

Exceedence: (not specifically defined, but interpreted from the text as): any value above primary or secondary drinking water standards at any monitoring location within the mine property and/or within any facility (e.g., tailings solution, pit water, waste rock runoff).

These definitions are important because they are not put in context of the regulatory requirements.

The purpose of NEPA is to identify potential impacts (or effects) to the components, structures, and functioning of an affected ecosystem (NEPA Section 1508.8). Therefore, a significant effect in surface water or groundwater might

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be the change of classification or use of a stream or aquifer. This makes the definition used for water quality impact in the Kuipers Maest Report the most stringent imaginable. It does not take into account important facts such as whether the increase is within mining or process facilities or constitutes an environmental release, whether it results in an exceedence of a regulatory limit, or whether it results in any environmental impact (e.g., change in downstream water classification). It is a threshold so low that no significant human activity could avoid triggering it.

From a regulatory perspective, mines are required to meet water quality standards at points of compliance such as downgradient monitoring wells or the end of a surface or groundwater mixing zone. Only exceedences of standards or permit limits at or beyond the points of compliance are potentially significant from a regulatory perspective. "Exceedences" at arbitrary locations throughout the operation are not necessarily meaningful. No mention of site-specific points of compliance are made in the Kuipers Maest Report, rather all monitoring sites are considered equal. An "exceedence" would be very likely at any mine site using the definitions in the Kuipers Maest Report.

Additionally, primary and secondary standards in mineralized areas are often exceeded in baseline water quality data. The Kuipers Maest Report does consider baseline conditions. However, the discussion is peripheral and inconsistent (e.g., historic mining impacts are often not defined). "Exceedences" of standards are noted in the report even when they are attributed to baseline conditions.

4.3 Data used

The Kuipers Maest Report utilized data from the following sources:

- Operational and post-operational water quality information from old EISs, especially for the states of Alaska, Montana, and Idaho, where updated EISs were often available,

- Technical reports and water quality data from State agencies that regulate mining activities in states such as Arizona, California, Nevada and Wisconsin,

- Post-mining Engineering Evaluation/Cost Analysis (EE/CA) documents from NEPA documents from some mines (e.g., Beal Mountain, MT; Grouse Creek, ID),

- Water quality data from files at the State agencies or from reports written by agency personnel or mining company consultants for mines in Arizona, Nevada, California, and Wisconsin where situations with multiple EISs did not exist or the EIS documents did not address water quality impacts.

While the authors recognized "that additional insights might have been gained by analyzing additional water quality data for the various mine sites", their focus was "on obtaining data that was verifiable and/or otherwise contained in prepared reports as a matter of efficiency".

Unfortunately, with the exception of defining the NEPA document utilized in the evaluation, the sources of data cited are generic (e.g., NDEP water quality monitoring and compliance data 1999-2003) and few actual monitoring station designations or descriptions are included for specific data. As a result, no independent evaluation of the data is possible. Additionally, no agency contact names are provided, nor are mining company or consultant reports cited.

One of the basic principles of scientific work is that data and data sources must be cited to allow others to duplicate the work. Lacking these citations, the Kuipers Maest Report cannot be verified in any meaningful way.

4.4 Evaluation of summary statistics

4.4.1 Case study Mines

The Kuipers Maest Report indicated there were 183 modern era mines, with 137 of those subject to NEPA. Of those mines, 71 had EIS information (104 EIS/EAs). Twenty-five (25) mines were chosen as "case study" mines because of availability of data. This included one (1) mine in Alaska, four (4) in California, two (2) in Idaho, six (6) in Montana, seven (7) in Nevada, and one (1) in Wisconsin. The report concluded the results of detailed evaluation of the case study mines could be extrapolated to other operations.

Using Table 4.1 of the Kuipers Maest Report, the 183 mine sites were verified (no independent assessment of time of operation was conducted). Of those, it was also verified that 137 were subject to NEPA. Of those with NEPA requirements, Table 4.1 of the Kuipers Maest Report indicates NEPA documents for 78 sites were obtained, while the report text indicates 71 sites had NEPA documents that were obtained.

Table 4.1 Summary of information presented in Table 4.1 of the Kuipers Maest Report

State	# 1975-present (~2005) mines listed	% of total	Number of sites w/EIS documents	% of sites w/ EIS docs	No. of case study mines	% of case study mines
Alaska	8	4.4	7	9.0	1	4.0
Arizona	20	10.9	10	12.8	2	8.0
California	15	8.2	8	10.3	6	24.0
Colorado	9	4.9	-	-	0	0
Idaho	14	7.7	7	9.0	2	8.0
Michigan	1	0.6	-	-	0	0
Montana	15	8.2	13	16.7	6	24.0
Nevada	74	40.4	27	34.6	7	28.0
New Mexico	7	3.8	1	1.3	0	0
South Carolina	3	1.6	-	-	0	0
South Dakota	5	2.7	1	1.3	0	0
Utah	7	3.8	4	5.1	0	0
Washington	4	2.2	-	-	0	0
Wisconsin	1	0.6	-	-	1	4.0
14	**183**	**100%**	**78**	**100%**	**25**	**100%**

Table 4.1 provides a summary of information contained in Table 4.1 of the Kuipers Maest Report. According to the summary statistics gleaned from this table, California and Montana mines are over-represented while Nevada mines are under-represented. Of the 14 states listed, 7 states are represented in the case studies (50%). Of the 14 states listed, 9 were listed as having available NEPA documents (64%). One mine, Flambeau in Wisconsin, was included in the case studies, but the site was not listed in the mines with EIS documents obtained in Table 4.1. Since the discussion for Flambeau in Section 6.3.25 includes reference to the 1990 EIS, it appears the table is in error.

Table 4.1 shows significant over-representation of California and Montana mines. This leads to under-representation of mines in Nevada, by far the most active state for new mining projects (40.4% of all mines in the study), and the state where the BLM is very active in developing guidance for analysis of mining operations. The states that are over-represented in the study have long mining histories, and many of the modern mines are located within historic mining districts that have a long history of old and unregulated mining activity. Historical activities are an un-controlled variable that is not accounted for in the Kuipers Maest Report. Moreover, the report includes three CERCLA sites within the 25 case study mines, which overstates the importance of old and "abandoned" sites and therefore skews the study results.

Considering the above statements, it is apparent that the Kuipers Maest Report has selected its study mines with significant bias towards old and unregulated sites. Therefore, it is not realistic to apply the conclusions of the report to current or future mining operations.

4.4.2 Surface and groundwater exceedences

Statements in the Kuipers Maest Report regarding the 25 case study mines include:

- 76% (19/25) had mining-related exceedences in surface water or groundwater

- 60% (15/25) had mining-related exceedences in surface water
- 64% (16/25) had mining-related exceedences in groundwater; 3 of the exceedences were related to baseline, therefore 52% (13/25) were related to mining impacts

These statistics appear to be the product of Table 7.1 of the Kuipers Maest Report: "EIS and Operational Water Quality Information for Case Study Mines." This table actually identifies 21 of the 25 mines as having water quality exceedences, but two of the groundwater exceedences (Round Mountain and Ruby Hill) are attributed to baseline conditions. Therefore, no mining-related water quality standard exceedences were identified at the following six mines: Round Mountain (NV); Mesquite (CA); Stillwater (MT); Castle Mountain (CA); American Girl (CA); and Ruby Hill (NV). Mines with violations or alleged violations noted in the text are more indicative of mines that have had compliance problems. Compliance problems at two of these sites (Zortman/Landusky and Beal Mountain) were a result of limited initial study. A total of nine (9) significant violations were noted which brings the percentage of mines with regulatory "exceedences" down to 36% (9 of the 25 mines).

A review of conclusions regarding actual and predicated water quality for each of the 25 case study mines described in Section 6.3 of the Kuipers Maest Report was conducted. For water quality, information from the description of Actual Water Quality Conditions for each mine was pasted into a table and the term "exceedence" or "violation" (if for water quality) was highlighted. Surface water and groundwater were differentiated in the table. Sources of information, as well as period-of-record, identified in the comparison are defined where available. The evaluation tables are provided as Appendix A. The result of this exercise is that the summary statistics could not be reproduced.

If such a study were to be conducted in the future, a more accurate and more realistic determination of water quality impacts from mines would involve reviewing data for compliance points to determine if there are exceedences. Judgment would be required because an occasional reported exceedence at a compliance point may not constitute an environmental impact (which is the purpose of reviewing projects under NEPA).

If the mines are separated by dates of initiation of mining, the percentage of case study mines with violations before 1970 is 100%, while those after 1990 is 0%. This is illustrated in Table 4.2.

Table 4.2 Violations/alleged violations at case study mines

Date	Name of Mine	Operations Started	Violation(s)/ Alleged Violations Noted*	Regulations Enacted
Pre-1970	Ray Mine, Arizona	1948	(2/2) **100%**	
	Bagdad, Arizona	1960		
1970s	Black Pine, Montana	1974	(1/3) **33%**	NEPA (1970 Clean Water Act (1972)
	Round Mountain, Nevada	1977		
	Zortman/Landusky, MT	1979		
1980s	Jerritt Canyon, Nevada	1980	(6/16) **38%**	CEQ NEPA Guidance (1983)
	Thompson Creek, Idaho	1983		
	Golden Sunlight, Montana	1983		
	Jamestown, California	1983		
	Greens Creek, Alaska	1984		
	Grouse Creek Idaho	1984		
	McLaughlin, California	1985		
	Mesquite, California	1985		
	Stillwater, Montana	1986		
	Florida Canyon, Nevada	1986		
	Rochester, Nevada	1986		
	Twin Creeks, Nevada	1988		
	Royal Mt King, California	1988		BC Task Force – Acid Prediction Guidance (1989)
	Beal Mountain, Montana	1989		
	Mineral Hill, Montana	1989		
	American Girl, California	1989		
1990s	Lone Tree, Nevada	1991	(0/4) **0%**	
	Flambeau, Wisconsin	1991		
	Castle Mountain, California	1992		
	Ruby Hill, Nevada	1997		

* Violations based on those alleged in the Kuipers Maest Report. No independent verification was conducted.

4.4.3 Contaminant leaching potential

The Kuipers Maest Report also defines the surface or groundwater exceedences by using the contaminant leaching potential described in one or more of the EISs, noting:

- 42% (8/19) predicted low contaminant leaching potential (but note that Table 7.1 only lists 5 (26%); 3 of the 8 included in the statistic are listed as "no information")

- 42% (8/19) predicted moderate contaminant leaching potential

- 15% (3/19) predicted high contaminant leaching potential

The contaminant leaching potential is used in this context to describe the ability of any material (e.g., pit wall, waste rock, tailings) to leach constituents. Current practice is to determine leaching potential using geochemical tests and then to compare the test results with site monitoring data to determine the actual mobility of constituents. In the Kuipers Maest Report, qualitative or calculated predictions in the EISs were scored. Qualitative statements were scored as stated on page 50: "if the EIS statement was somewhat negative (e.g., the potential for contaminant leaching exists), the entry was scored as a 2. If metals concentrations expected from mining operations were described as "low" or as not having significant increases over background/baseline concentrations, the entry was scored as a 1. For mines with multiple EISs, the EIS with the highest potential to generate contaminants was used as the score for the mine."

The contaminant leaching potential scoring system was defined as follows:

None - No information = 0

Low – leachate does not exceed water quality standards = 1

Moderate – leachate exceeds water quality standards by 1 to 10 times = 2

High – leachate exceeds water quality standards by over 10 times = 3

The following points were stated on page 50 of the Kuipers Maest Report:

- In the scoring, contaminant leaching potential was categorized according to the unit or material with the greatest potential to produce contaminants.

- The categories and factors chosen to score and describe contaminant leaching potential are not absolute in terms of potential environmental impact because different mines used different types of leaching procedures with different solid:liquid ratios (see Maest, et al., 2005) and different approaches to qualitatively describing the contaminant leaching potential.

- The potential for contaminant leaching is predicted without considering mitigation measures.

- The Environmental Protection Agency uses the toxic chemical leach procedure (TCLP) leachate standards for hazardous waste that are based on 100 times the drinking water standards. However, it is more appropriate to use the four categories listed above as a conservative approach (environmentally protective) to gain a rough understanding of the potential for contaminant leaching from mining waste.

Since none of the data are presented in the report, nor are calculations included, no reproduction of the scores is possible. Furthermore, a realistic review of the results is made difficult because of (i) the overly conservative definition of "exceedence", (ii) the lumping all EIS data together regardless of improvements in water quality/geochemical assessment or expanded requirements for characterization with time, and (iii) the expanded regulatory requirements through time. However, based on the scoring system presented and the stated disclaimers and assumptions (bullet points above), it is apparent that the Kuipers Maest Report uses overly-conservative scorings. It is also evident that the conclusions presented in the Kuipers Maest report do not rely on recognized or standard protocols for impact assessment and do not use points of compliance.

4.5 Summary

The evaluation of the summary statistics in the Kuipers Maest report can be summarized as follows:

- The Kuipers Maest Report defines an exceedence of surface or groundwater quality as any parameter above a primary or secondary surface or groundwater drinking water standard regardless of whether it is in compliance with permit conditions. This method makes it nearly impossible for any site with shallow groundwater or nearby surface water to not exceed standards.

- It is not possible to re-create the summary statistics cited in the Kuipers Maest Report using the information provided for case study mine sites.

- The general lack of citations for data sources or monitoring locations makes it difficult to confirm or deny conclusions reached in the report.

- Data from all NEPA documents are treated equally regardless of changes in scientific methods, regulatory requirements, or stated re-assessments of information; which is clearly not appropriate for a scientific study.

- Scoring systems in the document use uncharacteristically low criteria to define the severity of potential impacts

5 REVIEW OF CASE STUDY MINES IN THE KUIPERS MAEST REPORT

5.1 Background

The purpose of this chapter is to determine whether the Kuipers Maest Report accurately characterizes the actual impacts at mine sites that were used for the case studies. This current review selected four mines from the list of 25 case study mines to assess how the case studies were handled in the Kuipers Maest Report. The mines selected were: Golden Sunlight in Montana, Ruby Hill and Round Mountain in Nevada, and Flambeau in Wisconsin. The mines were selected to provide a temporal range of permitting and alleged compliance issues, and were also sites where data could be rapidly obtained for the purpose of review.

5.2 Golden Sunlight

Golden Sunlight is an operating mine located in Jefferson County, Montana. Two (2) Final EIS documents (1981 and 1998) and a Final EA (1990) were reviewed in the Kuipers Maest Report. Additionally, references to the 2005 Draft SEIS are made since both of the authors were involved in the Multiple Accounts Analysis (MAA) for this SEIS.

The Kuipers Maest Report concludes there was a failure in prediction of acid conditions based on the 1981 EIS. It is noted that the EIS document was compiled before the advent of standardized geochemical tests. The common and accepted knowledge at that time was that oxidized ores were not acid-generating (Sandi Olsen, former head of the Hard Rock Bureau, personal communication, 2004). The 1981 pit did not go below the water table and was developed in oxidized ore. As methodologies changed, more accurate predictions were made regarding the geochemical characteristics of the mined materials. Subsequent predictions at Golden Sunlight indicated a high potential for ARD and associated impacts and appropriate mitigation measures were implemented as a result.

5.2.1 Exceedences

The Kuipers Maest Report utilized data presented in the 1998 EIS (likely the 1997 Draft EIS, which contained the data). The following “exceedences” were defined in Section 6.3.14 of the Kuipers Maest Report. Additionally, actual impacts from the Appendix B tables (Table 14.1 for Golden Sunlight) are included.

- The Kuipers Maest Report notes “the primary source of existing groundwater contamination at Golden Sunlight is the tailings impoundment. The groundwater contains cyanide and copper concentrations above standards and has required numerous mitigations.

> Discussion: It is unclear which data were used from the 1997 Draft/1998 Final EIS, therefore it is difficult to comment on the accuracy of the statement. Volume 1 of the 1997 Draft EIS, page 158, under Evaluation of Historic Seepage Impacts to Current Groundwater Quality states “impacts to groundwater downgradient of the pumpback wells after 1990 have been greatly reduced or eliminated”. One graph of total cyanide and nitrate concentrations for downgradient monitoring location, OW-4, is presented in this section. No mention of copper could be found in relation to groundwater monitoring points downgradient. Based on information in the 2011 Annual Report,

copper concentrations are reduced to levels below any standard downgradient of the pumpback system indicating the pumpback system is functioning properly. The point-of-compliance for the minesite is at the downgradient end of the mixing zone, where no exceedences of any constituent have been identified since the mixing zone was established.

- According to Kuipers Maest Report, monitoring of existing waste rock dumps showed sulfide oxidation and potential for acid drainage, with some piles already producing acid drainage. Evidence shows some springs on the project site were impacted, but larger impacts to groundwater or surface water from the waste rock dumps have not been evident to date.

  Discussion: In contrast to the above statement, page 141 of Volume 1 of the 1997 Draft EIS states "No ARD is currently discharging from the waste rock dumps". The discussion continues "However, monitoring of conditions in reclaimed dumps shows that the waste rock has the geochemical potential to generate ARD and that oxidation of sulfide minerals is presently occurring due to infiltration of moisture. Monitoring data suggest that a wetting front is migrating very slowly through the dumps. The slow rate of this migration is attributed in part to efforts to limit meteoric water run-on by upslope catchments and partly to geochemical reactions, which consume or dissipate water. At present, these processes appear to be effectively limiting the production of ARD at dump toes and, therefore, its potential migration and impact on the local environment."

  The spring(s) showing impacts from the waste rock dumps were not identified by the Kuipers Maest Report. Page 147 of the 1997 Draft EIS states "Several springs in the Golden Sunlight Mine project area have chemical compositions that are strongly influenced by ARD-like solutions and have some elevated concentrations of sulfate and trace metals. These springs are considered natural…" The Kuipers Maest Report may be referring to the Midas Spring which was described on page 154 of the EIS as an intermittent spring that was possibly associated with an abandoned adit. This spring was covered by the East Waste Rock Dump and seepage is captured and sent to treatment.

With respect to the summary information regarding Golden Sunlight in Appendix B, Table 14.1:

- **Tailings**: Predicted impacts to groundwater and surface water were listed as "slight" in the 1981 EIS (incorrectly identified as the 1983 EIS in this table), 1990 EA, and 1998 EIS. Actual Impacts for tailings were identified as:

  - 1990 EA: Contamination of cyanide and copper in downgradient wells
  - 1998 EIS: Continued contamination of cyanide and copper in dowgradient wells
  - Water Quality Monitoring: Capture not 100% efficient due to operational problems

  Discussion: The cyanide and copper contamination issue was previously discussed. Monitoring results in the 2010 Annual Report indicate a consistent downgradient decline in all constituents associated with the tailings impoundment release. The Montana DEQ routinely recommends 80% capture efficiency for predictions.

- **Waste Rock**: Potential impacts to groundwater and surface water, based on more accurate geochemical predictions of the 1990s, were considered significant. Mitigations were proposed for potential impacts, as required by NEPA. No actual impacts were noted in the Kuipers Maest Report, although it was noted "springs near east waste rock dump and pore water in all waste rock dumps indicate long-term acid drainage and metals leaching impacts."

Discussion: The impact to springs was previously addressed. The mine identified the waste dumps as having a high potential to impact surface and groundwater without mitigation. Therefore, the actual conditions are consistent with predicted conditions.

- **Open Pit**: The predicted impact to pit water was not considered in the 1981 EIS because the pit was above the water table. Subsequent EA/EISs predicted the pit water would be characteristic of ARD. The mitigation for the pit is pumping into perpetuity. Therefore, the actual impacts are the same as the predicted impacts.

5.2.2 Summary

In summary, for the Golden Sunlight Mine:

- Golden Sunlight prepared its first EIS in 1981, before the advent of standardized methods for the prediction of ARD and before the requirement for any extensive evaluations. The proposed pit was above the natural water table, and was in oxidized rock.
- Predicted impacts in subsequent EA/EIS documents correctly predicted the high potential for ARD generation and associated impacts to groundwater and surface water.
- No exceedences have occurred at the point-of-compliance for groundwater.
- No impacts to surface water quality have been identified.

5.3 Ruby Hill

The Ruby Hill mine is located in Eureka County, Nevada and has been in operation since 1997. An EIS was completed in 1997 and the Kuipers Maest Report summarizes the water quality predictions. Subsequently, an SEIS was completed in 2005 to predict potential impacts associated with deepening the pit below the groundwater table.

5.3.1 Exceedences

The Kuipers Maest Report noted that water quality monitoring and compliance data were obtained from the Nevada Department of Environmental Protection (NDEP) for the period 1997-2003. The 2005 DEIS (BLM, 2005) also summarized water quality at the site. Nine groundwater monitoring locations were noted for the site.

The following "exceedences" were alleged in Section 6.3.23 of the Kuipers Maest Report:

- "Only two constituents had substantially high concentrations: arsenic and nitrate. Two wells had high arsenic concentrations, often exceeding MCL values by two to four times; concentrations increased by about 20% between 1996 and 2003. However, the highest concentration occurred upgradient of the mine.

- Elevated pH values were also common in groundwater wells. Nitrate concentrations frequently approached the MCL in several wells. The 2005 EIS suggested these predated the mine and were due to septic systems. There were lead exceedences (less than twice the drinking water standard) during the fourth quarter of 1997 and the first quarter of 1998 in monitoring well MW -4, although no problems were recorded after this point. Since the exceedences did not recur, it did not result in any action by NDEP.

Water quality impacts were not expected and did not occur. Therefore, assuming that the exceedences are related to baseline conditions, the water quality predictions were accurate.

Discussion: Underground mining has occurred in the vicinity of the Ruby Hill mine since the early 1900s. The long un-regulated history of underground mining activity in the Eureka Mining District has resulted in complex baseline water quality conditions at the site. The alleged exceedences do not substantiate any potential impacts due to recent mining activity because they did not recur and they were related to pre-existing groundwater conditions.

The 1997 and 2005 EIS documents provide a good characterization of the baseline conditions, and the Kuipers Maest Report supports that the predicted and observed conditions at the Ruby Hill mine were accurate. As a result of the predictions, mitigation measures were implemented successfully, and in a timely manner, to reduce arsenic concentrations in the dewatering discharge, thus facilitating use of the Rapid Infiltration Basins to return the water from the dewatering system back to the water resources of the Diamond Valley groundwater basin.

5.3.2 Summary

The Ruby Hill mine provides a good example of the current adequacy of the NEPA process with regard to EIS document preparation after the late 1990's.

5.4 Round Mountain

Round Mountain is an operating mine in Nye County, Nevada. The mine has been in operation since 1977 and EAs were completed for mine expansions in 1987 and 1992. The Kuipers Maest Report provides a summary of the water quality predictions that were reviewed for the 1996 EIS, which was conducted to support the mine milling and tailings expansions.

For the evaluation of actual water quality conditions, the Kuipers Maest Report utilized water quality monitoring and compliance data obtained from the Nevada Department of Environmental Protection (NDEP) for the period 1999-2003. Data from ten groundwater monitoring locations were reviewed for the site.

5.4.1 Exceedences

Exceedences of aluminum, fluoride, iron, lead, manganese, and TDS in groundwater were reported in Section 6.3.22 of the Kuipers Maest Report. The report states that: "the cause of the exceedences in groundwater is not known, but could be due to background groundwater quality and/or discharge from the tailings or heap leach facilities or dewatering water. Because the waste rock was shown to have a significant potential to leach contaminants, the fact that there is relatively little groundwater contamination indicates the mitigation may be working. However, there are trends that cannot be explained by assuming that all exceedences are background. Fluoride is the biggest issue especially since it is a constituent of concern for leaching from the waste rock. It suggests that the baseline water quality was not adequately determined."

Discussion: Examining the 1996 EIS, there appears to be adequate discussion and supporting data to address the occurrence of elevated fluoride with respect to baseline water quality. The document states that "The chemical composition of shallow alluvial water samples at the site may be a result of mixing Tertiary volcanic, geothermal, and recharge waters in different proportions. Elevated concentrations of fluoride in samples from the shallow alluvial monitoring wells in the southern and western portions of the site suggest an influence from geothermal water"; and also "Deeper groundwater in the vicinity of the geothermal wellfield (Table 3-9, GS-1, 2, 5 and J-2) had elevated fluoride and arsenic concentrations as well as elevated pH and temperature values. Samples from shallow alluvial and deeper geothermal waters in this area of the project site all had fluoride concentrations exceeding the Federal secondary maximum contaminant level of 2.0 milligrams per liter and ranged as high as 27.5 mg/l". (Round Mountain Mine EIS, February 1996)

5.4.2 Summary

The Round Mountain case study provides an example of how the Kuipers Maest Report has failed to properly analyze the hydrology, and has therefore misrepresented the monitoring data. Per the 1996 EIS and supporting studies, the baseline concentrations and source of fluoride in the groundwater system (in the vicinity of the Round Mountain Mine area) have been adequately documented. The Kuipers Maest Report has omitted this documentation and has therefore misrepresented the site conditions and impacts. On-going monitoring at the site supports a high fluoride concentration anomaly in the area of the documented geothermal resource area, which remains within the mine POO boundary. The elevated fluoride concentration associated with the geothermal resource will remain within the capture zone of the post closure pit lake, which will constitute a permanent hydrogeologic sink.

5.5 Flambeau

The Kennecott Flambeau Mine is located in Rusk County in northwestern Wisconsin. The mine encompassed 181 acres, with the pit covering about 35 acres. During its 4+ year mine life (1993 to 1997), the mine produced 181,000 tons of copper, 334 ounces of gold and 3.3 million ounces of silver. Ore was shipped via rail for processing at a mill in Ontario, Canada. The Kuipers Maest Report, in Section 6.3.25, incorrectly identifies the Flambeau Mine as an open pit lead and zinc mine with flotation processing, operating from 1991 to 1995.

A certificate of completion and bond release was issued in 2007 for 149 acres of the reclaimed site. In association with the City of Ladysmith, four miles of walking trails have been developed on the reclaimed site and 10 miles of equestrian trails have been developed adjacent to the mine site and the Flambeau River. Additionally, at the request of the City of Ladysmith, 32 acres of the mine site were set aside for a business and recreation park. The area has three former mine buildings occupied by tenants and provides a trailhead and parking for the adjacent equestrian trails.

Information from Table 25.1 in the Kuipers Maest Report is compared to information presented in the 2009 Annual Report for the mine. The Annual Report was available online at www.flambeaumine.com .

5.5.1 Exceedences

The Kuipers Maest Report utilized monitoring and compliance data for the period 2000 to 2003 obtained from the 2003 Annual Report, Groundwater and Surface Water Trends. One surface water monitoring location and four groundwater monitoring locations were used. The following exceedences were alleged in the Section 6.3.25 of the report:

- "Four monitoring wells in the backfilled pit showed exceedences of drinking water MCLs or secondary standards for iron (up to 12 mg/l), manganese (up to 37 mg/l), pH (as low as 6.1), sulfate (up to 1,700 mg/l) and total dissolved solids (up to 3,400 mg/l). One in-pit well showed continued increasing or elevated concentrations of iron, sulfate, TDS, and manganese; other wells showed decreasing concentrations. Groundwater elevations were higher in the backfilled pit than they were between the pit and the river, so water potentially flows from the pit to the river. After groundwater elevations returned to pre-mining levels, concentrations of iron, manganese, sulfate and TDS increased and pH decreased. Values for pH before pumping began were quite variable (5.8 - ~8.3). Concentrations appeared to peak in 2000 and were slowly decreasing for manganese (from a high of over 5,000 µg/l), sulfate (from a high of almost 700 mg/l) and TDS (from a high of ~1,300 mg/l), but are continuing to increase for iron (up to ~6 mg/l). Zinc concentrations were variable and still (as of 2003) ~700 µg/l (Lehrke, 2004)."

  Discussion: Increases in some parameters in groundwater in the backfill were predicted as noted. The in-pit wells are not compliance points. The pit is the area of the mine where the system was designed to re-equilibrate and was not required to have parameters below groundwater drinking water standards. Therefore, the pit water referred to by the Kuipers Maest Report is actually in compliance with regulation.

- "Although concentrations in surface water up and downgradient of the mine showed no temporal water quality trends, a report from the Great Lakes Indian Fish and Wildlife Commission stated that water quality parameters measured have changed from those measured during mine operation, and that the change makes it impossible to compare during- and post-mining water quality (Coleman, 2004). In addition, the report states that the downstream sample site SW-2 is located above the discharge point for surface water coming from the southeast portion of the mine site and therefore may not capture all releases from the mine."

  Discussion: No surface water impacts have been detected in the Flambeau River. Historical data from the 2009 Annual Report show the mine has measured field pH, conductivity, copper, hardness, and zinc from 1991 onward. Iron, manganese and sulfate were added to the constituent list in November 1999. Trend analyses show declining levels of copper and zinc.

5.5.2 Summary

In summary, for the Flambeau Mine:

- The Kuipers Maest Report does not state that in-pit wells are not compliance points and infers that the elevated constituent values represent compliance excedances,

- Surface water data indicate the Flambeau River is not impacted by mine activities.

6 CONCLUSIONS

The key conclusions from this review of the Kuipers Maest Report are as follows:

- The findings of the report are not relevant to any current mines that are being permitted, or to any future mines. Current characterization and analysis techniques have changed so radically from virtually all of the studies cited by the Kuipers Maest Report that it is meaningless to draw any comparison to current predictive evaluation protocols or permitting requirements and conditions.

- The conclusions regarding water quality exceedences cannot be validated. There are virtually no data presented by the Kuipers Maest Report that support the report conclusions. Where data are available, the cited exceedences are often for internal and trigger monitoring points rather than for compliance points that affect the surrounding environment and receptors.

- The data set used in the Kuipers Maest Report includes historical sites, which were put into production before any regulatory constraints even existed. The report also includes a preponderance of mine sites that were studied and permitted during the transition period from un-regulated activity to current regulation, before predictive protocols existed. The study draws conclusions based upon technical work that is old, and may no longer be technically supportable or valid. There is an under-representation of modern mine sites, which have been studied, operated and regulated using modern-day methods.

- The four case studies examined by the current review have highlighted that the Kuipers Maest Report has serious problems in the way that data are represented and interpreted, and in the way conclusions are drawn. The report merely extracts data without trying to understand the conceptual model of the mine site in question, the hydrogeological and geochemical processes involved, or the site-specific nature and layout of the site. Consequently, much of the data interpretation is out of context, so it is not surprising that the resulting conclusions are misleading.

- The Kuipers Maest Report neglects to discuss that increasing data collection and improved models and predictive methodologies contribute to refinements in predictions and site conceptual models. This despite the authors acknowledging the same in their 2005 report on state-of-the-art of predictive methods wherein they include the quote: *"The site conceptual model must be representative of the most important processes and reactions that will occur over time on the mine site, and <u>it can change with time at the mine site and as more information is collected</u>" (Bredehoeft, 2005).*

- The Kuipers Maest Report has defined "impacts" differently from most regulatory bodies with which the mining industry has to comply. The report defines an exceedence of surface or groundwater quality as any parameter above a primary or secondary surface or groundwater drinking water standard regardless of whether it is in compliance with permit conditions.

- The Kuipers Maest Report argues that many of the exceedences are due to "characterization failures". However, virtually all of the EISs for study mines cited in the report were prepared prior to the BLM guidance for water resource and rock characterization and analysis. Within the context of current analytical techniques, the conclusion has no validity.

- The Kuipers Maest Report includes very little consideration of ambient hydrogeological conditions that were present prior to the development of the mining operation, and particularly cases where modern-day mining has cleaned up older mining operations.

- It is not possible to re-create the summary statistics cited in the Kuipers Maest Report using the information provided for case study mine sites. Scoring systems used in the document have unrealistically low criteria to define the severity of potential impacts.

REFERENCES

Bureau of Land Management, 2005. "Ruby Hill Mine Expansion-East Archimedes Project Final Supplemental Environmental Impact Statement," Battle Mountain Field Office, Nevada.

Bureau of Land Management & Montana Department of Environmental Quality, 1998, "Final Environmental Impact Statement for the Golden Sunlight Mines, Inc.; Amendment 008 and Mine Life Extension."

Bureau of Land Management, 1997(a), Ruby Hill Project, "Final Environmental Statement," Battle Mountain District, Battle Mountain Nevada, January 1997.

Bureau of Land Management, 1996, "Round Mountain Mill and Tailings Facility final environmental impact statement (EIS), for the Smoky Valley Common Operation, Nye County, Nevada," Battle Mountain District, Battle Mountain, Nevada.

Bureau of Land Management & Montana Department of State Lands, 1981, Environmental Impact Statement for Amendment 001. April 1981.

Coleman, J. 2004. Memorandum from John Coleman, Great Lakes Indian Fish and Wildlife Commission, to Neil Kmiecik, Biological Services Director. Re: Report on the status of the Flambeau Mine, February 22, 2004.

Kuipers, James R. and Maest, Ann S. et al., 2006, Comparison of Predicted and Actual Water Quality at Hardrock Mines: The reliability of predictions in Environmental Impact Statements.

Lehrke, S. 2004. Memorandum from Stephen Lehrke, Foth & Van Dyke, to Jana Murphy, Flambeau Mining Company. Re: Flambeau Mining Company – 2003 Annual Report Groundwater and Surface Water Trends. January 1, 2004.

Maest, A., J. Kuipers, C. Travers, and D. Atkins. 2005. Predicting Water Quality at Hardrock Mines: Methods and Models, Uncertainties, and State-of-the-Art.

Olsen, Sandi, Personal Communication (with Kathy Gallagher), formerly Hard Rock Bureau, Montana Department of Environmental Quality, 2004.

United States Forest Service, 1991, Greens Creek Environmental Assessment, Alaska Region.

United States Forest Service, 1983, Greens Creek Final Environmental Impact Statement, Alaska Region, Admin. Doc. Number 115, January.

Appendix A

Review of Golden Sunlight and Flambeau Mines

Information Presented in Appendix B of the Kuipers Maest Report

Responses to Table 14.1 – Summary of Potential, Predicted and Actual Impacts and Mitigations at the Golden Sunlight Mine, Montana: Groundwater and Surface Water						
Resource	**Source**	**Potential Impacts**	**Mitigations**	**Predicted Impacts**	**Actual Impacts**	**RESPONSE: Actual Impacts**
1981 EIS						
Groundwater and Surface Water	Tailings	Geochemical tests indicate ARD potential but site indications used to suggest low actual potential Potential for contamination of groundwater from tailings solution containing cyanide	Facility design to prevent ground-water and surface water impacts: o use of finger drains o clay liner o cutoff trench o impervious nature of the underlying sediments	Risk to groundwater "slight"	None listed	An additional mitigation listed in the EIS was the construction of downstream monitoring wells. Monitoring wells were required even though monitoring systems were optional at that time unless pollutants were "likely to reach surface waters or present a substantial risk to public health" – ARM 16.20.633 (4). The EIS noted groundwater impacts were viewed as possible due to "a drainage system failure or irregularities in the underlying soil materials…" Because of its chemistry, cyanide was not viewed as a significant problem, although the EIS noted heavy metals were a "potentially greater concern." Data through time have indicated continual declines in downgradient constituents. No parameters are above designated levels at the mixing zone boundary.
	Waste Rock	Same as above	No mitigations identified as needed	Risk from ARD "minimal"	WQ Monitoring: No actual impacts noted to date although springs near East waste rock dump and pore water in all waste rock dumps indicated long-term ARD and metals leaching impacts	In 1981, the agencies generally viewed oxidized rock as non-acid generating. Widespread guidance for prediction of ARD using static and kinetic testing was not available until the late-1980s. Subsequent evaluations utilized relevant guidance and it was determined waste rock had a high acid generating potential. There was an analysis for the 1981 EIS that indicated acid generating potential, but observational data suggested ARD would not be an issue. No seepage from the waste rock dump complexes is evident today, although it is anticipated based on analyses in subsequent EISs.

Responses to Table 14.1 – Summary of Potential, Predicted and Actual Impacts and Mitigations at the Golden Sunlight Mine, Montana: Groundwater and Surface Water						
Resource	**Source**	**Potential Impacts**	**Mitigations**	**Predicted Impacts**	**Actual Impacts**	**RESPONSE: Actual Impacts**
						While baseline data are limited, a 1980 water sample was collected from a spring located north of the proposed impoundment (now known as Tailings Impoundment No. 1). The pH was 5.48 with TDS of 533 mg/l and a sulfate concentration of 315 mg/l. Pre-historic ferricrete formation at the site indicates a long history of acidic water from the strongly mineralized area. The spring(s) referenced are not defined, but acidic seeps were present before placement of the East Waste Rock Dump. The Midas seep is described in detail in the 1997 Draft EIS.
Groundwater, Surface Water and Pit Water	Open Pit	Pit not expected to go below groundwater level	No mitigations identified as needed	No impacts to water quality	WQ Monitoring: Monitoring of pit water indicates ARD characteristics	The pit analyzed in the 1981 EIS did not extend below the natural groundwater table and there was no pit water. Pit water was analyzed in subsequent environmental assessments when the pit would extend below the natural water table. The ARD characteristics of the pit walls and pit water resulted in plans to capture all pit discharge for treatment.
1990 EA						
Groundwater and Surface Water	Tailings	Potential for ARD and metals in leachate	Capture of contaminated groundwater o Slurry walls and down-gradient wells	Prevent contamination from becoming more extensive in groundwater and protect surface water	Contamination of cyanide and copper in downgradient wells	The accidental release from TI#1 is discussed under the 1981 "Tailings" section. Tailings Impoundment No. 2 was designed with a liner and a variety of collection basins. High copper and cyanide concentrations were identified downgradient from the initial pumpback wells. Two additional rows of pumpback wells were installed and the area is maintained as a sink. Pumpback wells east of the impoundment were also

Responses to Table 14.1 – Summary of Potential, Predicted and Actual Impacts and Mitigations at the Golden Sunlight Mine, Montana: Groundwater and Surface Water						
Resource	**Source**	**Potential Impacts**	**Mitigations**	**Predicted Impacts**	**Actual Impacts**	**RESPONSE: Actual Impacts**
						installed. Captured water is routed to Tailings Impoundment No. 2. No levels of total cyanide or dissolved copper exceeding standards have been identified at the mixing zone boundary. Commitment to treat mine discharges in perpetuity.
	Waste Rock	Significant potential for ARD and metals in waste rock leachate	Capture of contaminated groundwater o Slurry walls and down-gradient wells Engineered covers to reduce leachate production	Mitigation to prevent significant long-term impacts from acid drainage.	No actual impacts noted to date although springs near east waste rock dump and pore water in all waste dumps indicate long-term ARD and metals leaching impacts.	See discussion below for 1998 EIS "Waste Rock." Waste rock is expected to produce acid. Commitment to treat mine discharges in perpetuity.
Groundwater, Surface Water and Pit Water	Open Pit	Significant potential for ARD and metals in leachate from open pit	Capture of contaminated pit water	Mitigations to prevent significant long-term impacts from ARD	WQ Monitoring: Monitoring of pit water indicates ARD characteristics	Pit water captured and routed to water treatment plant and impoundment. Commitment to treat mine discharges in perpetuity.
1998 EIS						
Groundwater and Surface Water	Tailings	Short-term tailings leak containing cyanide and other contaminants expected to continue	Capture of contaminated groundwater o Slurry walls and down-gradient well o Landowner buyouts o Replacement water provided	Little or no long-term impact to groundwater from ARD	Continued contamination of cyanide and copper in downgradient wells Capture not 100% efficient due to operational problems	The accidental release from TI#1 is discussed under the 1981 "Tailings" section. Tailings Impoundment No. 2 was designed with a liner and a variety of collection basins. The TI#2 east reclaim basin liner leaked in 1995. Monitoring revealed the leak and the basin liner was repaired. No evidence of leakage currently exists. A site-wide mixing zone at the permit boundary has not had any parameter exceedences including total cyanide and copper. Capture was never expected to be 100%.

Responses to Table 14.1 – Summary of Potential, Predicted and Actual Impacts and Mitigations at the Golden Sunlight Mine, Montana: Groundwater and Surface Water						
Resource	**Source**	**Potential Impacts**	**Mitigations**	**Predicted Impacts**	**Actual Impacts**	**RESPONSE: Actual Impacts**
						Typically 80% capture efficiency is used in mixing calculations. Some EIS analyses (presented in the appendices) indicated higher capture efficiencies were possible.
	Waste Rock	Significant potential for impacts from ARD and metals over long-term	Capture of contaminated groundwater o Slurry walls and down-gradient well o Installation of drains and other seepage capture devices Reclamation cover to decrease long-term potential for impacts from ARD	Mitigations to prevent significant long-term impacts from ARD in surface water	WQ Monitoring: No actual impacts noted to date although springs near east waste rock dump and pore water in all waste rock dumps indicated long-term ARD and metals leaching impacts	The spring(s) near the East Dump are not identified. The former Midas Spring occurred in an active slump area now covered by the East Waste Rock Dump. Historically, the spring was intermittent and did not always emerge from the same location, probably due to the changing hydraulic conditions in the slump. The source of this water is still uncertain, but could be the result of discharge from the abandoned Midas Adit, which is now covered by waste rock. The drainage above the slump (to the west) may provide a catchment area for precipitation, which infiltrates into the ground and is directed into the slump, re-emerging as a contact spring. Water from the former Midas Spring is intercepted and conveyed by pipeline to the Golden Sunlight Mine mill facility. Flow measurements taken from the discharge line are low (approximately 1-3 gpm).
Groundwater, Surface Water and Pit Water	Open Pit	Pit water expected to be characteristic of ARD	Capture and treatment – no pit lake allowed to form	Mitigations to prevent significant off-site impacts from ARD	WQ Monitoring: Monitoring of pit water indicates ARD characteristics	The ARD characteristics of the pit water have been well documented. Since the pit was developed below the water table, the pit closure plan has required dewatering and treatment.

Responses to Table 25.1 (Appendix B) – Summary of Potential, Predicted and Actual Impacts and Mitigations at the Flambeau Mine, Wisconsin: Pit Leachate and Groundwater						
Resource	**Source**	**Potential Impacts**	**Mitigations**	**Predicted Impacts**	**Actual Impacts**	**RESPONSE: Actual Impacts**
1990 EIS						
Pit Backfill Leachate	Pit backfill	Pit backfill will eliminate pit waters	Backfilling to eliminate possibility of a pit lake. Liming of backfill.	Pit backfill will eliminate pit waters. Predicted leachate concentration in pit backfill was 0.014 mg/l copper, 0.32 mg/l iron, 0.725 mg/l manganese, and 1,360 mg/l sulfate	Four monitoring wells in the backfilled pit show exceedences of drinking water standards for Fe, Mn, pH SO_4, and TDS. One in-pit well shows continued increasing or elevated concentrations of Fe, SO_4, TDS, and Mn; other wells show decreasing concentrations.	Increases in some parameters in groundwater in the backfill were predicted as noted. The pit is the area of the mine where the system was designed to re-equilibrate and was not required to have parameters below groundwater drinking water standards. Annual Reports from 2005 to 2009 are available from www.flambeaumine.com . The 2009 Annual Report (Section 4.1.1) notes "SRK Consulting performed annual assessments reviewing results from the 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008 and 2009 monitoring of pore water quality. The monitoring results and assessments confirm the findings presented in the year 2000 monitoring results assessment. An annual assessment was again performed by SRK Consulting reviewing the results from the 2009 monitoring of pore water quality. The February 2010 memorandum, Flambeau Project – Backfilled Pit 2009 Monitoring Results is found in Appendix A. The results from the 2009 monitoring period generally are in agreement with the results from previous years and support the conclusions previously identified. In general, the results indicate that the objectives of the lime amendment program had been met and that any acidity that had been present in the waste rock has been neutralized. The results further indicate that concentrations of major ions in the pore water are stable. For most of the backfill porewater, sulfate concentrations are controlled by gypsum dissolution/precipitation. However, isolated zones are developing where backfill gypsum equilibrium conditions do not exist (e.g. around well MW-1014C). The results provide ample evidence that the porewater in these areas is being displaced by inflowing groundwater. For example, concentrations of sulfate and other solutes are decreasing around Well MW-1014C, without any evidence that precipitation reactions are causing the decrease. This 2009 Annual Report also includes a map of monitoring

Responses to Table 25.1 (Appendix B) – Summary of Potential, Predicted and Actual Impacts and Mitigations at the Flambeau Mine, Wisconsin: Pit Leachate and Groundwater						
Resource	**Source**	**Potential Impacts**	**Mitigations**	**Predicted Impacts**	**Actual Impacts**	**RESPONSE: Actual Impacts**
						locations, trend analyses, and statistics.
Groundwater	Pit backfill	Waste rock from the mining operation would have the potential to leach contaminants to groundwater.	High sulfur waste stockpiles and ore crushing/loading areas lined. Treatment of mine water before discharge; Liming of backfill. Settling ponds to collect runoff from low sulfur stockpiles	Slightly increased TDS, hardness, SO_4, Fe, Mn may be expected from leachate infiltration. No impacts from high sulfur stockpile, ore crushing areas. Worst-case leakage would leak into mine pit where water would be treated before discharge. Groundwater under ponds flows to pit, limiting contamination.	Samples taken from a well between the river and the pit show exceedences of drinking water standards for Fe (2.8-7.4 mg/), Mn (3.1-4.2 mg/l), pH (5.9-6.2), SO_4 (250-460 mg/l), and TDS (810-1,100 mg/l)	Section 4.1.1 of the 2009 Annual Report also states: "As part of the permitting effort for the Flambeau project, assessments were completed to determine if the reclaimed site would comply with the permitted groundwater quality standards at the compliance boundary and protect surface water quality in the Flambeau River. The original assessment relied on predicted post-mining hydrologic conditions to conclude that the Flambeau River would act as a hydrologic boundary for the pore water migrating from the pit backfill and that backfill pore water would not migrate to the downgradient compliance boundary. In addition, the original analysis showed that the flux of backfill pore water into the river would be so small relative to the flow in the river that surface water quality would not experience a measurable change. Section 2.2 of the 2009 Annual Report summarizes groundwater quality assessments as follows: "Assessments of the backfill groundwater quality have been routinely performed with the most recent being completed in January 2010. The assessments show that the regional groundwater flow, including backfill water, is flowing toward the Flambeau River as was predicted during permitting; stable conditions have been reached at depth within the backfill; manganese concentrations appear to have stabilized or are decreasing over the last three years; any acidity that had been present in the backfill has been neutralized by the limestone; sulfate concentrations in the majority of the backfill are now controlled by gypsum precipitation and dissolution; and concentrations of solutes in the backfill are stable and should not significantly increase in the future and, in fact, many are showing a decreasing trend. Further detail on groundwater quality can be found in Section 4 of this report." Data for all wells are also provided in appendices to the 2009 Annual Report.